(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 782 948 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.02.2021 Bulletin 2021/08

(51) Int Cl.:
B66B 29/02 *(2006.01)*

(21) Application number: **19192839.9**

(22) Date of filing: **21.08.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **KONE Corporation**
00330 Helsinki (FI)

(72) Inventors:
- **Osthoff, Matthias**
  00330 Helsinki (FI)
- **Carsten, Rolf**
  00330 Helsinki (FI)
- **Mnich, Andreas**
  00330 Helsinki (FI)
- **Balkenhol, Norbert**
  00330 Helsinki (FI)

(74) Representative: **Kolster Oy Ab**
(Salmisaarenaukio 1)
P.O. Box 204
00181 Helsinki (FI)

(54) **ESCALATOR SYSTEM**

(57) The invention relates to an escalator system (1) comprising a step band (4) extending between a first end (2) of the escalator system and a second end (3) of the escalator system, a skirt (7) extending along a side of the step band (4) with an outer surface (8) in close proximity to the side of the step band (4), and a bracket having a first end attached to the skirt (7) and a second end attached to a truss (9). In order to allow controlled movement of the skirt, at least the first end or the second end of the bracket is attached via a spring to the skirt (7) or truss (9), respectively.

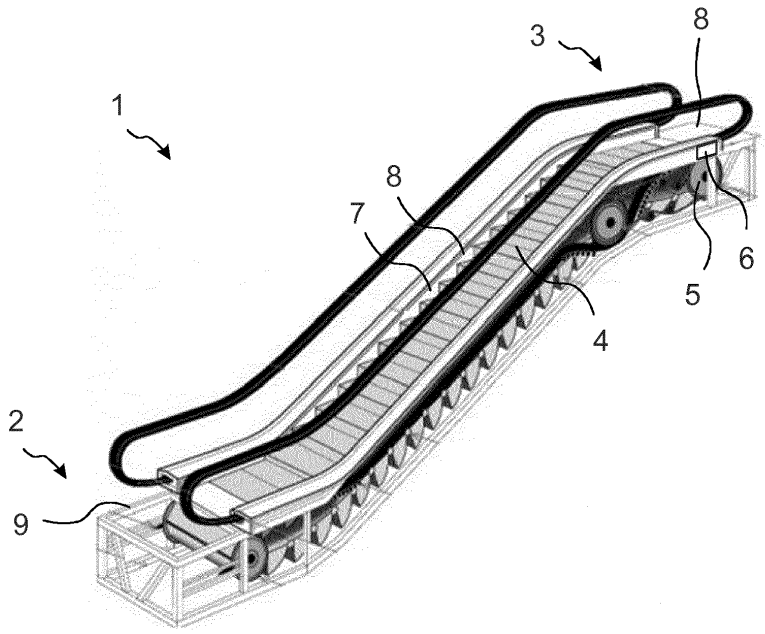

FIG. 1

EP 3 782 948 A1

Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] This invention relates to an escalator system and more particularly to a solution improving the safety devices of the escalator system.

DESCRIPTION OF PRIOR ART

[0002] A challenge with an escalator system is to ensure that users of the escalator system (or objects) are not stuck between moving parts of the escalator system. In this regard, one potential location where such a risk exists is the gap between the skirt and the side of the step band.

[0003] In praxis the escalator system has skirts extending along the step band on opposite sides of the step band from the first end of the escalator system to the second end of the escalator system. In case something gets stuck in a gap between a skirt and the step band, a force is generated by the stuck object which attempts to push the skirt sideways away from the step band. In such a situation, an emergency stop should be triggered as soon as possible.

[0004] A challenge with an escalator system of this type is that the attachment brackets between the skirt and the truss of the escalator system attempt to prevent the previously mentioned force from moving the skirt sideways away from the step band when an object is stuck in the gap. Due to the fact that sufficient sideways movement is not achieved, there is a risk that the sensors are not able to reliably detect at all locations a situation where something is stuck in the gap, which prevents or at least delays an emergency stop of the escalator system.

SUMMARY OF THE INVENTION

[0005] An object of the present invention is to solve the above-mentioned drawback and by providing a novel escalator system. This object is achieved with the escalator system according to independent claim 1.

[0006] When a bracket having a first end attached to a skirt and a second end attached to a truss of an escalator system is implemented such that at least the first or second end of the bracket is attached via a spring to a skirt or truss, respectively, the above-mentioned problem is solved. With such a solution sufficient movement of the skirt can be obtained by means of the spring. Due to sufficient movement the sensors are reliably and quickly able to detect the stuck person or object.

[0007] Preferred embodiments of the invention are disclosed in the dependent claims.

BRIEF DESCRIPTION OF DRAWINGS

[0008] In the following the present invention will be described in closer detail by way of example and with reference to the attached drawings, in which

Figure 1 illustrates an escalator system, and
Figures 2 to 4 illustrate attachment of a skirt to the escalator system of Figure 1.

DESCRIPTION OF AT LEAST ONE EMBODIMENT

[0009] Figure 1 illustrates an escalator system 1, where by way of example a first end 2 of the escalator is located lover than a second end of the escalator 3. Consequently, in this illustrated example the escalator extends between different floors of a building, for instance. Alternatively, the first end and the second end of the escalator may be both arranged on the same floor, in which case the escalator can be used for transporting persons from one location to another while remaining on one single floor (such as same vertical level). Therefore, in this application the term "escalator" includes also moving ramps and autowalks, in other words people conveyers arranged in one single floor only or to extend between different floors.

[0010] In Figure 1 the escalator system 1 comprises a step band 4 extending between the first end 2 and a second end 3 of the escalator. During use, this step band is driven by an electric motor 5 under control of a control unit 6.

[0011] A skirt 7 extends along a side of the step band 4 with an outer surface 8 of the skirt 7 in close proximity to the side of the step band 4. In praxis the escalator system is provided with a skirt 7 on both opposite sides of the step band 4 in close proximity to the sides of the step band in an attempt to keep the gaps between the skirts and step band sufficiently small to prevent that objects or persons using the escalator could be stuck in this gap. The outer surface 8 of the skirt 7 is in this example planar, and the skirt 7 is attached to the truss 9 of the escalator system by brackets such that no direct contact exists between the truss and skirt, as illustrated by way of example in Figures 2 to 4.

[0012] Figure 2 illustrates the inner surface of the skirt 7 (opposite to the outer surface 8 and turned away from the step band 4) with an attachment bracket 10, Figure 3 is a cross-section along line III - III of Figure 2, and Figure 4 is a cross-section along line IV - IV of Figure 2.

[0013] The bracket 10 has a first end 11 attached to the skirt 7 and a second end 12 attached to a truss 9 of the escalator system. The truss 9 is a rigid frame part of the escalator system and provides a firm and non-movable attachment point for various parts of the escalator system, such as for the bracket 10. In praxis the skirt 7 is attached by a plurality of such brackets to the truss 9 in such a way that no direct contact exists between the truss and skirt, due to which the skirt may move in a

controlled way in relation to the truss, in case the attachment of the brackets make this possible.

[0014] In this illustrated example the bracket 10 is L shaped, such that the first end 11 of the bracket 10 extends generally along the longitudinal direction 14 of the skirt 7, while the second end 12 of the bracket 10 extends substantially perpendicularly away from the skirt 7, for instance. In this way the second end 12 of the bracket 10 can be attached to the truss 9 by bolts (not illustrated), for instance. It should be observed, that in Figure 2 the location of the truss is only schematically illustrated, in praxis the actual location and shape of the truss may vary case by case.

[0015] In order to facilitate that the skirt 7 is able to move away from the step band 4 in a controlled way when needed, the attachment of the first end 11 of the bracket 10 to the skirt 7 is implemented by a spring, or alternatively, the attachment of the second end 12 of the bracket to the truss 9 is implemented via a spring. In either case the used spring facilitates that, when needed, a sufficient amount of movement of the skirt 7 is possible in relation to the truss 9, such that a sensor 13 monitoring the position of the skirt 7 can detect this movement, also at the location of the bracket 10, and provide the control unit 6 with control signals indicating the detected position of the skirt. Typically, such movement of the skirt 7 is needed to occur when an object is stuck in the gap between the skirt 7 and the step band 4. Due to the control signals from the sensor 13, the control unit 6 can detect a change in the position of the skirt, and trigger an emergency stop for the electric motor 5 in order to stop the step band 4 from moving.

[0016] The type of the sensor 13 used may vary. In Figure 2 the sensor 13 is illustrated only schematically by way of example as a part attached to the truss 9. In such an installation, an infrared or radar sensor may provide a signal indicating the distance between the sensor and the inner surface of the truss. Alternatively, it is also possible to utilize as a sensor an optical fiber whose shape is changed due to contact with one or more of the parts used in the skirt attachment, such that the optical properties of the optical fiber temporarily change and due to this the control unit 6 can detect the change in the position of the skirt.

[0017] In the illustrated example, it is by way of example assumed that the spring is arranged specifically to attach the bracket 10 to the skirt 7 in a movable way, while the bracket 10 is attached to the truss 9 in a fixed, non-movable way. In this example, the utilized spring is an elongated leaf spring 15. A first end 16 of the leaf spring 15 is attached to a first end 11 of the bracket 10, while a second end 17 of the leaf spring is attached to the skirt 7.

[0018] In the illustrated example, the skirt 7 comprises on the inner surface attachment points including generally C-shaped rails 18, washers 19 and nuts 20 for facilitating attachment of the skirt 7 to the leaf spring 15. The leaf spring 15 is arranged in such a way that in a non-tensioned state the leaf spring 15 maintains a gap 21 between the first end 11 of the bracket 10 and the skirt 7, which allows the skirt to move a predetermined distance defined by the gap 21 towards the bracket 10 against the spring force of the leaf spring 15. Consequently, the skirt 7, while moving towards the bracket (and truss), moves away from the step band 4. A suitable size for the gap is 1 mm, for instance. This movement is detected by the sensor 13 and control unit 6, such that an emergency stop can be triggered. However, the attachment of the skirt 7 is implemented in a such a way, that the skirt 7 is under all conditions prevented from moving away from the bracket and truss 9, in other words towards the step band 4.

[0019] In order to obtain an attachment for the skirt 7 which provides the previously mentioned controlled movement of the skirt, three bolts are utilized in the illustrated example. The second end 17 of the leaf spring 15 is provided with a bolt 26 and a nut 20 which together attach the second end 17 of the leaf spring 15 in a non-movable way to the skirt 7. In the illustrated example, the bolt 25 and nut 20 attach the leaf spring 15 to the skirt 7 via the rail 18 of the skirt 7.

[0020] The first end 16 of the leaf spring 15 is provided with an outermost bolt 22 and with an intermediate bolt 23 such, that the intermediate bolt 23 is located between the outermost bolt 22 and the second end 17 of the leaf spring 15. The intermediate bolt 23 attaches the first end 16 of the leaf spring 15 to the first end 11 of the bracket without attachment to the skirt 7. Consequently, the skirt 7 can move in relation to the combination of the leaf spring 15 and bracket 10 at the location of the intermediate bolt 23 against the spring force of the leaf spring when the leaf spring bends due to the force from the skirt 7.

[0021] The outermost bolt 22 has a first end 24 and a second end 25. The first end 24 of the outermost bolt is attached to the skirt 7 (in the illustrated example to the rail 18 of the skirt) to prevent the first end 24 of the bolt from moving away from the skirt 7 towards the bracket 10. In the illustrated example, the first end 24 is received in a nut 20, which is larger than the gap in the rail 18 of the skirt 7 such that the rail keeps the first end 24 non-movable against the rail 18 of the skirt 7.

[0022] The outermost bolt 22 extends from the first end 24 away from the skirt through a hole in the first end 11 of the bracket 10 and a hole in the first end 16 of the leaf spring 15 to the second end 25 of the outermost bolt 22. The second end 25 of the outermost bolt 22 is attached to the leaf spring 15 to prevent the second end 25 of the bolt from moving through the hole in the leaf spring 15 towards the skirt 7. In the illustrated example the head of the outermost bolt 22 located in the second end 25 has a larger diameter than the hole in the leaf spring 15, which prevents the second end 25 from passing through the hole in the leaf spring towards the skirt 7.

[0023] The leaf spring 15 maintains in a non-tensioned state, as illustrated in Figures 2 to 4, a gap 21 between the first end 11 of the bracket 10 and the skirt for allowing

the skirt 7 to move a predetermined distance defined by the gap 21 towards the bracket 10 against a spring force of the leaf spring 15 when the leaf spring is bent due to the force from the skirt 7. In the illustrated example, as best seen in Figures 3 and 4, this gap is located between the washer 19 of the skirt 7 and the first end 11 of the bracket 10. The size of the gap 21 varies depending on the implementation, one alternative is to utilize a gap which is about 1 mm wide. This facilitates that the skirt 7 may move 1 mm towards the bracket 10 (and truss), which is sufficient for a sensor 13 to detect a change in the position of the skirt.

[0024] In the illustrated example, a spacer element 27, as illustrated in Figure 3, extends along the outermost bolt 22 through the holes in the first end 11 of the bracket 10 and the first end 16 of the leaf spring 15 and maintains a predetermined distance between the second end 25 of the outermost bolt 22 and the skirt 7. In the illustrated example this space element 27 is provided in the form of a tube surrounding the bolt 22.

[0025] The illustrated example of the attachment between the skirt 7 and truss 9 has the advantage that the skirt 7 may move against the spring force of the leaf spring 15 away from the step band 4, however, movement of the skirt 7 in the opposite direction towards the step band is efficiently prevented. Additionally, the skirt is also prevented from moving upwards or downwards. These directions are illustrated by arrow 28 in Figure 2. An additional advantage with the illustrated solution is that the attachment of the skirt mainly corresponds to existing skirt attachments of existing escalator systems. Consequently, only minor modifications are needed, such as adding the leaf spring with the related attachment parts, in order to modify these existing escalator systems to have skirts that move as previously explained.

[0026] It is to be understood that the above description and the accompanying figures are only intended to illustrate the present invention. It will be obvious to a person skilled in the art that the invention can be varied and modified without departing from the scope of the invention.

Claims

1. An escalator system (1) comprising:

a step band (4) extending between a first end (2) of the escalator system and a second end (3) of the escalator system,
a skirt (7) extending along a side of the step band (4) with an outer surface (8) in close proximity to the side of the step band (4), and
a bracket (10) having a first end (11) attached to the skirt (7) and a second end attached to a truss (9), **characterized in that**
at least the first end (11) or the second end (12) of the bracket (10) is attached via a spring (15) to the skirt (7) or truss (9), respectively.

2. The escalator system according to claim 1, wherein the first end (11) of the bracket (10) is attached to the skirt (7) by a spring (15) while the second end (12) of the bracket is non-movably attached to the truss (9).

3. The escalator system according to claim 2, wherein the spring is a leaf spring (15) having a first end (16) attached to the bracket (10) and a second end (17) attached to the skirt (7).

4. The escalator system according to one of claims 2 to 3, wherein in a non-tensioned state the leaf spring (15) maintains a gap (21) between the first end of (11) the bracket (10) and the skirt (7) for allowing the skirt (7) to move a predetermined distance defined by the gap (21) towards the bracket (10) against a spring force of the leaf spring (15).

5. The escalator system according to claim 3, wherein the first end (16) of the leaf spring (15) is provided with an intermediate bolt (23) and an outermost bolt (25), where the intermediate bolt (23) is located between the outermost bolt (22) and the second end (17) of the leaf spring (15),
the intermediate bolt (23) attaches the leaf spring (15) and the first end of the bracket (11) non-movably to each other without attachment to the skirt (7),
the outermost bolt (22) has a first end (24) and a second end (25), the first end (24) of the outermost bolt (22) is attached to the skirt (7) to prevent the first end (24) of the bolt from moving away from the skirt (7) towards the bracket (10), the outermost bolt (22) extending from the first end (24) away from the skirt (7) through a hole in the first end (11) of the bracket (10) and a hole in the first end (16) of the leaf spring (15) to the second end (25) of the outermost bolt (22), the second end (25) of the outermost bolt (22) is attached to the leaf spring (15) to prevent the second end (25) of the outermost bolt (22) from moving through the hole in the leaf spring (15) towards the skirt (7), and
the leaf spring (15) maintains in a non-tensioned state a gap (21) between the first end (11) of the bracket (10) and the skirt (7) for allowing the skirt (7) to move a predetermined distance defined by the gap (21) towards the bracket (10) against a spring force of the leaf spring (7).

6. The escalator system of claim 5, wherein a spacer element (27) extends along the outermost bolt (22) through said holes in the first end (11) of the bracket (10) and the first end (16) of the leaf spring (16) and maintains a predetermined distance between the second end (25) of the outermost bolt (22) and the skirt (7).

7. The escalator system according to one of claims 1 to 6, wherein the escalator system (1) comprises
a motor (5) driving the escalator system under control of a control unit (6), and
a sensor (13) monitoring the position of the skirt (7) and providing the control unit (6) with control signals indicating the detected position of the skirt (7), wherein
the control unit (6) is configured to stop the motor (5) from driving the escalator system (1) when the control signals provided by the sensor (13) indicates a change in the position of the skirt (7).

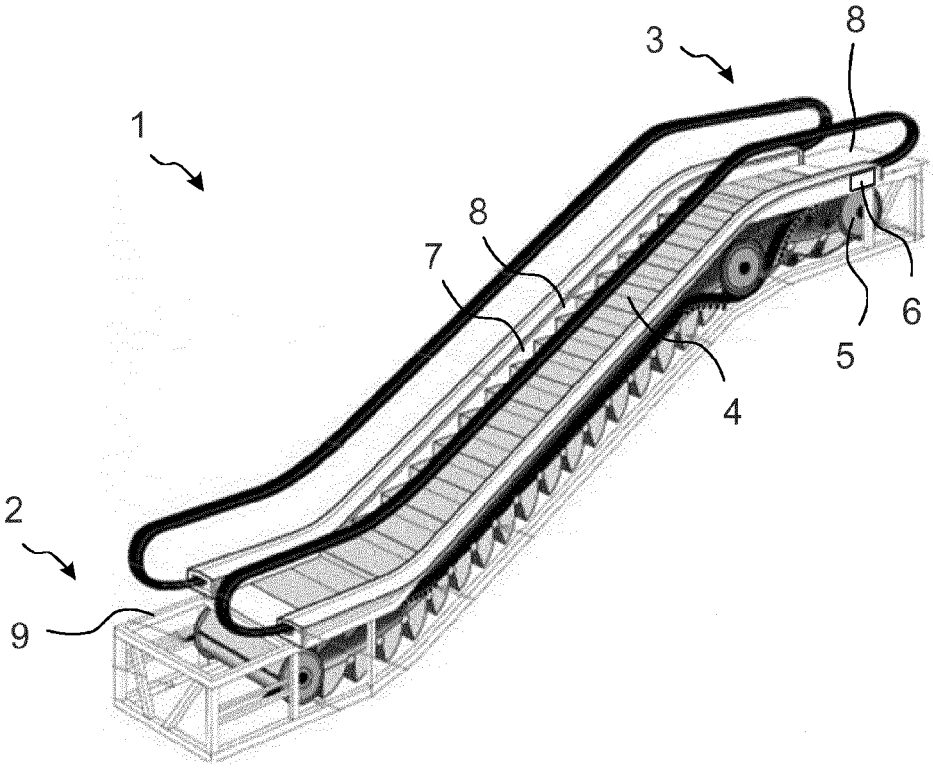
1
2
3
4
5
6
7
8
8
9

FIG. 1

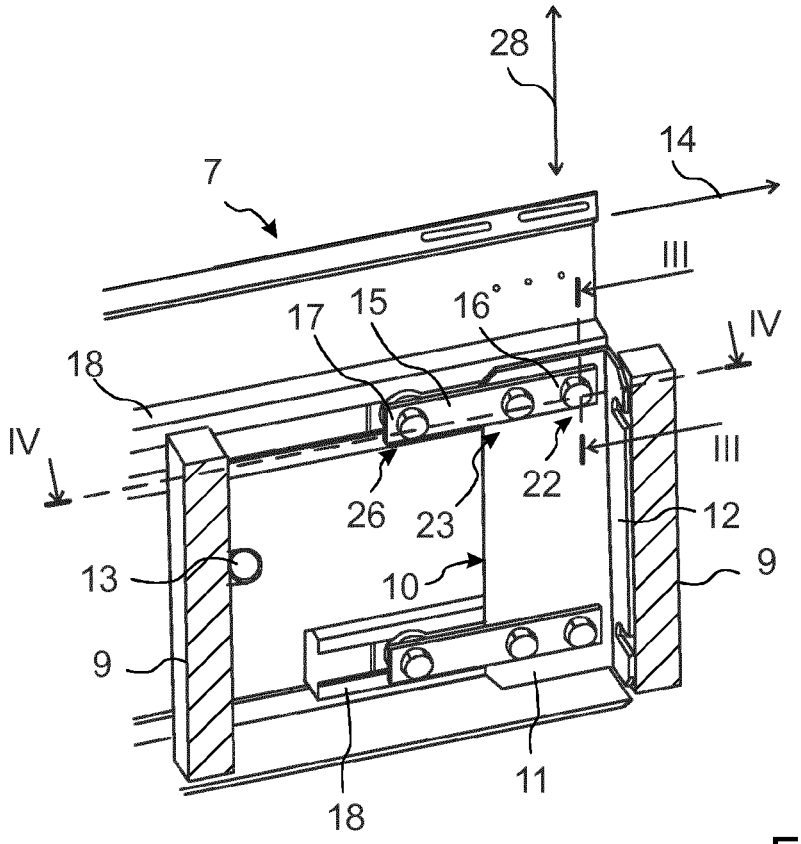
7
9
10
11
12
13
14
15
16
17
18
18
22
23
26
28
III
III
IV
IV

FIG. 2

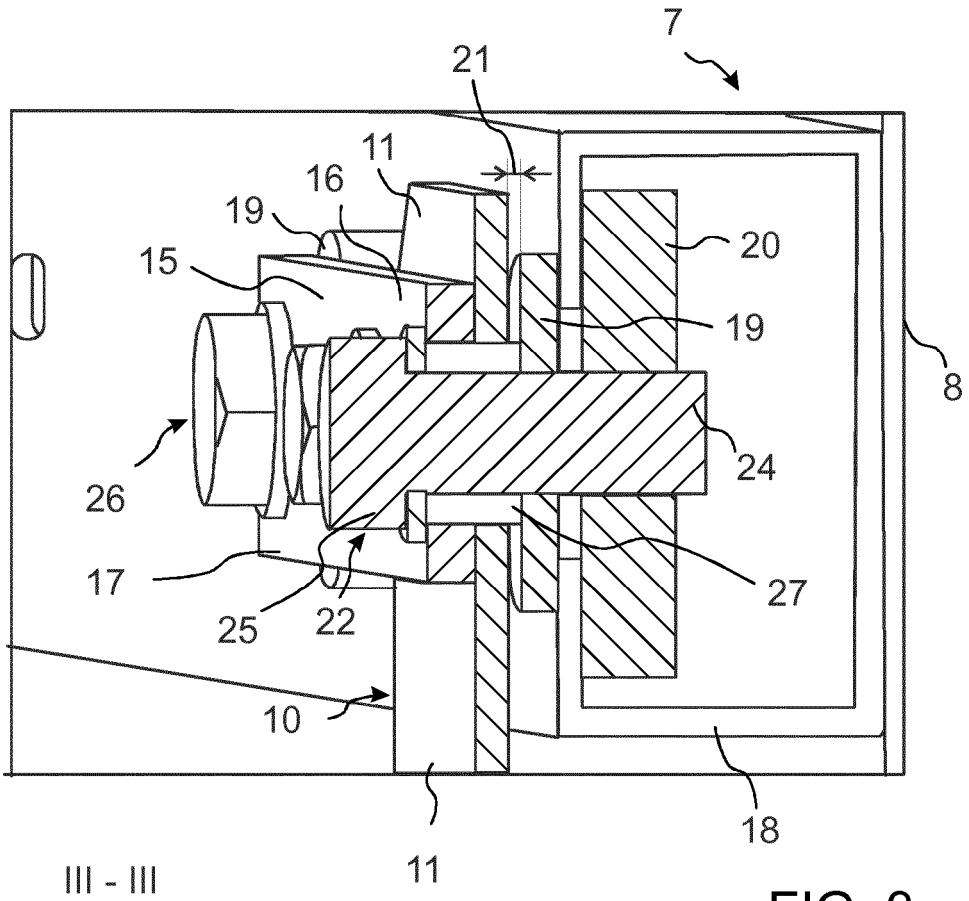
7
21
11
16
19
15
20
19
8
24
26
17
25
22
27
10
18
11
III - III

FIG. 3

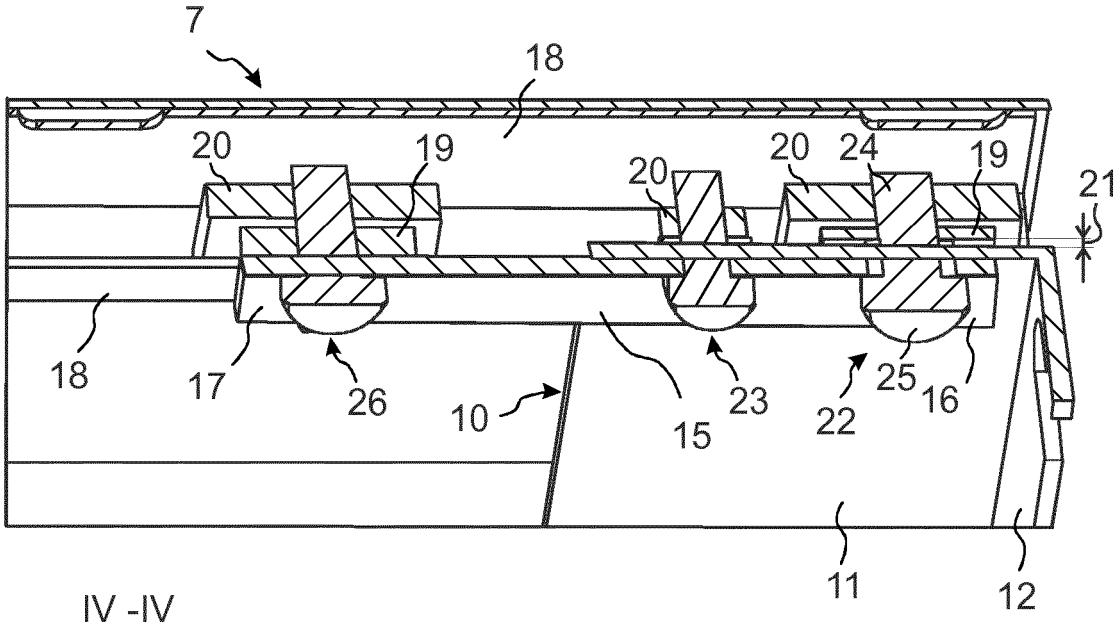
7
18
20
19
20
20
24
19
21
18
17
26
10
15
23
22
25
16
11
12
IV -IV

FIG. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 19 2839

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 181 710 A (THYSSEN MAN AUFZUEGE) 29 April 1987 (1987-04-29)	1-4,7	INV. B66B29/02
A	* figure 1 *	5,6	
X	CN 103 086 250 A (CANNY ELEVATOR CO LTD) 8 May 2013 (2013-05-08)	1-4,7	
A	* figure 1 *	5,6	
X	JP H04 327491 A (TOSHIBA CORP) 17 November 1992 (1992-11-17)	1-4,7	
A	* figures 1-3 *	5,6	
A	JP 2004 307161 A (MITSUBISHI ELEC BUILDING TECHN) 4 November 2004 (2004-11-04) * figure 2 *	1-7	

TECHNICAL FIELDS SEARCHED (IPC)

B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 February 2020	Lenoir, Xavier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 19 2839

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-02-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2181710 A	29-04-1987	DE 8529320 U1	09-01-1986
		GB 2181710 A	29-04-1987
CN 103086250 A	08-05-2013	NONE	
JP H04327491 A	17-11-1992	JP 2786753 B2	13-08-1998
		JP H04327491 A	17-11-1992
JP 2004307161 A	04-11-2004	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82